Where and Why?

?

HARD MAPLE in the INDUSTRIES

(Facts for quick reference.)

HARD MAPLE

is "a man's wood," in his business and in his sports. And, also, it is "a woman's wood" in the embellishment of the home, with very long service.

THIS BOOK

tells, with authority, and in very conservative terms, the "Why, Where and When and How," of

HARD MAPLE

for quick and responsible reference by those who wish to know the reasons for certain standardized preferences.

Written by O. T. Swan, Engineer in Forest Products

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Cadillac, Michigan

Hard Maple
The Standard
in the
Industries
(Hard maple)

The Strenght of HARD MAPLE is equalled by its graceful beauty.

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HARD MAPLE

Its Strength, Properties and Commercial Uses.

The user of lumber wants to know what wood will best serve a given purpose and the basic reasons which should determine his choice. He demands comparative figures showing the measure of the various mechanical properties of different woods.

The fabricator of metal products has long had exact data as to comparative strength, weight and similar factors so that his choice has been determined with fair accuracy and his designs made with consequent efficiency.

Exact information on the comparative strength values of wood has become available only within the last few years. The results of these tests have made it necessary to revise many conceptions which had been popularly held as to the comparative strength of different woods and as to the manner in which woods act under different strains.

It is the purpose of this booklet to provide a quick and easy reference to the technical facts regarding HARD MAPLE, its structure, properties and behavior in use. This information will serve as a better basis for the selection of wood and for the design of wooden products.

The official strength tests made by the U. S. Forest Products Laboratory at Madison, Wisconsin, are used as the basis of the tabulations on mechanical properties as given in this booklet.*

Incidentally, you will find much technical information concerning other northern hardwoods, Birch, Beech and Rock Elm, and other woods of commerce, which have frequently been used where considerable strength is required.

This analysis of official figures will show that HARD MAPLE has a remarkable combination of strength qualities, supplemented by an attractive appearance in its various finished forms, which have made it the preeminent choice for a great many exacting uses.

**Acknowledgment is made to the U. S. Forest Products Laboratory at Madison, Wisconsin. The tabulations of strength values and much of the explanation of methods of test are from published reports by J. A. Newlin, in charge of Timber Tests, and T. R. C. Wilson, Engineer in Forest Products, both of the U. S. Forest Products Laboratory. The Laboratory has completed several hundred thousand strength tests on the commercial woods of America.*

To one considering the comparative service properties of hardwoods it is a significant fact that HARD MAPLE is the only wood used in the manufacture of bowling pins. It is a significant fact that it is the chosen wood for billiard cues. The user of wood may well consider what properties have made HARD MAPLE the chosen wood for meat cutters' blocks, ladder rungs, wooden type, laundry machinery, mangle rollers and for many other very exacting uses where some peculiar property of strength, hardness and stability of shape is absolutely essential. Also, there is an interesting property of HARD MAPLE which makes it the leading wood used in the manufacture of musical instruments.

It becomes clear why HARD MAPLE in the automobile industry is often referred to as "the rattle-proof hardwood."

As a consumer of wood, anxious to make the best possible selection of material for specific uses, you will wish to make a careful examination of the data given in this report. It is official data and you may draw your own conclusions.

THE HARD MAPLE TREE

As a background to any consideration of why and how the particular values of HARD MAPLE may be profitably used, it is interesting to first learn something about the growth of the tree, and the HARD MAPLE forests of the North are among the practical triumphs of romantic Nature.

Foresters now know that strength values, grain and texture depend measurably upon forest conditions, soil conditions and climatic conditions. Wood, in the main, is simply a compact structure of long, hollow fibers, called cells. The strength of the wood depends very largely upon the characteristics of individual cells, whether they are thin-walled or thick-walled and whether the cells are relatively large. Soil, climatic and other forest conditions have a very appreciable effect upon the development of this wood structure, so that wood from one tree of the same species from one region, may not have the same strength qualities as wood of the same species from another part of the country.

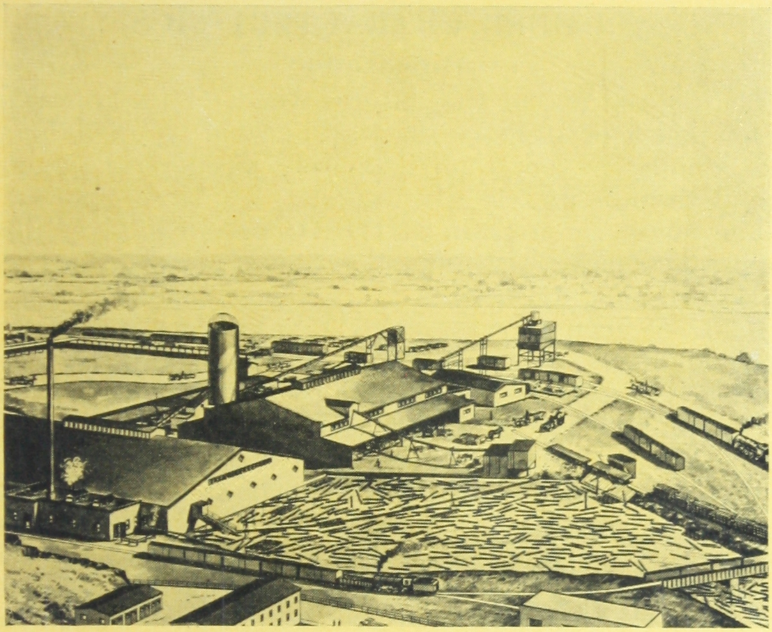
"WHERE JUDGMENT IS BEST, HARD MAPLE IS SUREST"

Typical HARD MAPLE, as found only in Wisconsin and Michigan, where this "super-hardwood" reaches its finest development.

Hard Maple logs starting on their career of usefulness.

The HARD MAPLE tree reaches its best development in Michigan and Wisconsin. In order to produce wood of the best texture it is important that trees of nearly any species shall not grow too rapidly or too slowly. There is a rate of growth which produces the best wood. Climatic conditions in Michigan and Wisconsin are such that the wood of HARD MAPLE in those states is of very high quality in texture, hardness and strength. This is the result of the slow, firm, even growth in the primeval Northern Hardwood forests.

The HARD MAPLE grows slowly and steadily to a diameter, breast-high, of from 12 to 24 inches, and from 60 to 80 feet in height. A National figure in forestry and lumber has said, "Wood-lots of Sugar Maple in Michigan and Wisconsin present pictures of health, vigor, cleanliness and beauty which no forest tree surpasses." "The intense green and density of the crowns in summer make the trees conspicuous in any landscape where they occur, while their brilliant colors in autumn are the chief glory of the forests



From the log to the wood-working industries; a typical Hard Maple Saw-Mill.

where they abound." Makers of Sugar in the North, call the HARD MAPLE Sugar Maple but lumbermen and users of wood nearly always speak of it as HARD MAPLE. The scientific name is *Acer Saccharum.*

All Maples are fairly hard and some varieties are very, very hard. Sugar may be obtained from most of them but the Sugar or HARD MAPLE is hardest of all and the most prolific sugar-maker, hence both names are appropriate.

In Michigan and Wisconsin this tree also is frequently termed Rock Maple. This name refers to the hardness of the species as found in the above states.

The bulk of the HARD MAPLE lumber of commerce originates in Michigan and Wisconsin and over 60% of the Maple lumber, including all of the species of this wood produced in the United States, originates in Michigan and Wisconsin. It is here that the splendid hardwoods of the north have developed into great history-making forests.

LUMBER CHARACTERISTICS

Appearance

The appearance of the natural wood, or its appearance under polish or stain, or the way in which it holds paints and enamels, rather than its purely mechanical qualities, may determine its selective use.

The dense, even grain of HARD MAPLE gives it the important characteristic of smoothness, which means gloss or luster under finish.

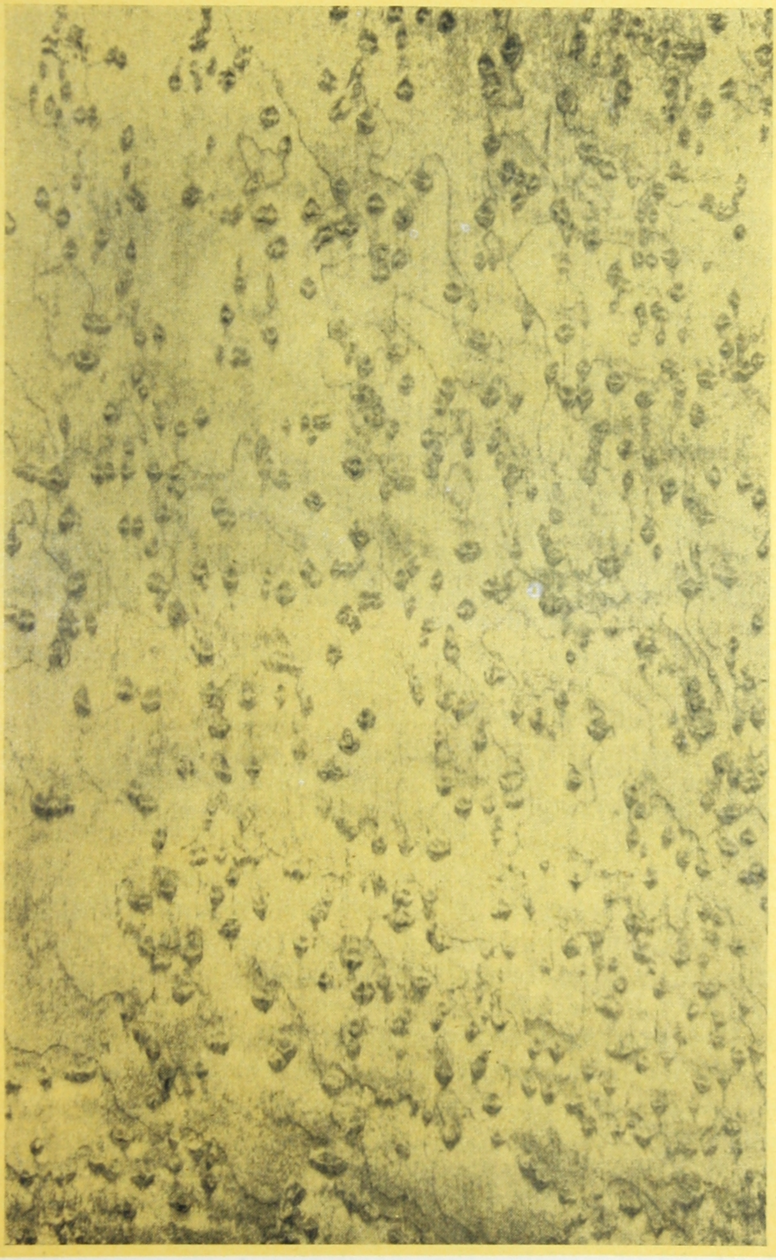
Being of even growth, HARD MAPLE shows a light, soft graining. The sapwood is clear white, while the heartwood is reddish brown and these two effects may be found in the same board, or one or the other may be graded out.

The older a tree grows, the greater is the percentage of heartwood and the less the percentage of clear, white sapwood. Many large trees contain but little colored heart, and trees are generally fifty years old before they have any of it. HARD MAPLE in the tree will probably average fewer defects than other hardwoods, but such as they are, these defects must be considered in sorting the boards for the buyer and user. Whether the finished products of the saw-mill contain some or none of the characteristic defects of HARD MAPLE depends upon how the boards have been sorted. This matter of sorting, or grading, will be explained when inspection and grading are discussed.

Besides the usual grain, three distinctive, special figures are found in HARD MAPLE and, to some extent, in other Maples. These figures are known as Birdseye, Curly and Blister Maple. They are accidental, occurring only in occasional trees and, when desired, are sorted out during manufacture. The percentage obtained is very small.

Naturally enough, the uses of HARD MAPLE are nearly universal where a hard, white wood is wanted. Its characteristic natural finish is in much demand for machines having wooden parts; for some kinds of implements; and for interior trim and fixtures, residence furniture, school and church furniture, for professional instruments and the like.

The natural grain of a wood is of importance in considering finished appearance, and the texture of HARD MAPLE makes it available for treatment by color either through impregnation or by the staining of its surface.



Fanciful grain is rare in HARD MAPLE, but can be had.

Enamel work and paint require a smooth, firm, backing and a supporting surface which will not easily mar or show indentations. HARD MAPLE has these qualities in very high degree as a base for enamel and paint.

Some truly wonderful effects are possible in the treatment of Curly or Birdseye Maple, and, to the skillful designer, HARD MAPLE, more than most species, presents rare and charming possibilities both in form and color. It is like canvas to the painter, or marble to the sculptor.

As such, it is worthy of careful study and trial by those whose abilities make them the "explorers" for American industry, if they have not already joined the long list of those who have discovered these qualities in HARD MAPLE and have long been enjoying their advantages.

Penetrability

The introduction of various liquids into the cellular structure of wood is frequently a matter of prime importance, and the penetrability of various species is a factor in their suitability for special uses.

The impregnation of wood is usually for preservation against decay, fire or insect attacks, or for the production of desired color effects by stain or paint.

Thoroughly dried wood naturally is more penetrable, both by gases and liquids, and certain processes, such as high pressure steaming as applied in commercial wood preserving plants, increase penetrability.

HARD MAPLE is not easily penetrable, but is sufficiently so to permit the protection of its natural staunchness by creosote oil, zinc chloride and other preservatives for outdoor uses by railways, such as railway ties buried in the soil.

In the industrial fields and in railway uses there is a steadily increasing use of treated HARD MAPLE for cross ties, bridge timbers, wooden culverts and other special timber requirements.

HARD MAPLE is susceptible to stain and yields color effects of remarkable softness, richness and beauty, where so treated for interior finish or use in furniture.

In finished articles the wood has a characteristically clean, clear cut, firm appearance, conveying instinctively the idea of beauty and long service.

Railroad safety and track-permanence account for great quantities of HARD MAPLE ties. (Above are enroute to creosoting.)

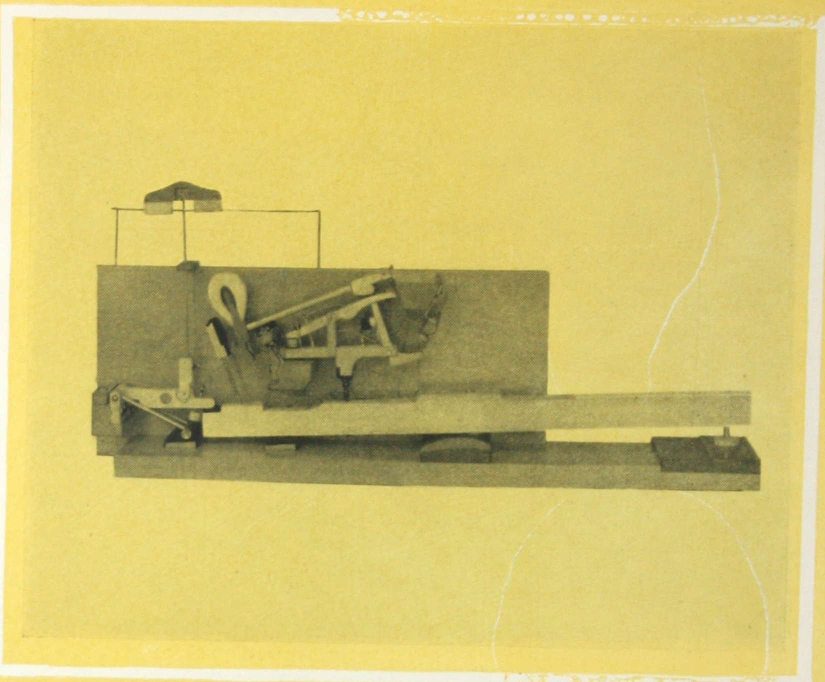
Clear White Maple Flooring is in great demand, but for those who prefer other shades in the development of color schemes in the home, many stains ranging from light to dark, in browns, dark reddish colors, and other tints have been worked out and applied successfully to Maple Floors.

Resonance

This vital quality in wood for use in musical instruments is dependent upon its natural physical structure, both as to nature and uniformity.

For example, the vibrations of the strings of a piano are transmitted to the wood-structure and are given clear richness and volume of tone by the symphonic responsiveness of the vibrations of the wood. It follows that for such uses the wood must be specially selected.

Irregularity in structure excludes almost all hardwoods from such use, while choice of suitable woods among the



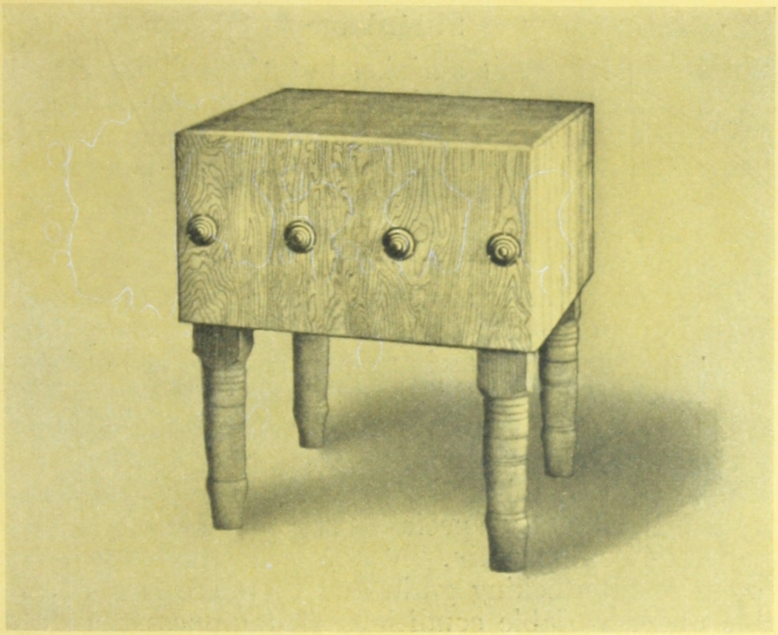
"Symphonic vibration," as well as uniform strength, requires HARD MAPLE throughout in fine piano-actions.

conifers is limited by the necessity for combining strength with those wood-structure requirements necessary for clear resonance. That is, there should be relative freedom from resin and entire absence of pronounced bands of dense wood mixed with open-growth grain.

More HARD MAPLE than any other wood is used in musical instrument manufacture, the piano industry alone requiring enormous quantities of this wood. HARD MAPLE furnishes both the strength for the instrument and the true, even wood-structure necessary for volume and sweetness of tone-production.

Taste and Scent

Wooden packages for food products must, unless the contents are in sealed package units, be practically free from any characteristic odor in the wood, and in the case



Every good butcher insists on Hard Maple blocks.

of many food packages where wood comes in direct contact with the product, it is essential that the wood should not impart any unpleasant taste, or any taste whatever.

Particularly is this necessary in creamery products.

A report of the New York College of Forestry states that in New York butter-box manufacturers are using large quantities of HARD MAPLE. The interior wooden parts of churns, dashers in ice cream freezers and in similar articles are nearly always of Maple. Manufacturers of wooden ware, including such articles as chopping bowls, wooden spoons, bread boards, etc., prefer HARD MAPLE. Maple veneer is often pressed into various kinds of food containers, including those for butter. Butcher meat blocks are nearly always made of HARD MAPLE. It is the one wood which will stand up well under this very harsh and exacting use.

Experience causes HARD MAPLE to be the preferred wood where wood and food must come in close contact.

Shrinkage

When wood dries it shrinks, but the cellular structure of various kinds of woods is not uniform and so there are characteristic variations in shrinkage in different species. Further, the shrinkage of one piece of Maple is more likely to be about the same as in another piece of Maple on account of the uniform wood-structure of this species than in the case in those hardwoods, or soft woods, where there is considerable variation in cellular growth in different trees.

When wooden parts open at the joints, when there is warping or twisting or a change in the evenness of the surface of wood, it is usually due to the shrinkage of wood as it loses part of its moisture, while the absorption of moisture has a tendency to reverse these effects.

If wood is dried uniformly there is not likely to be warping or twisting unless the species is one which is characterized by an interlocking grain. Maple is not characteristically of cross or interlocking grain and therefore is much more stable under variable conditions of dampness than woods of that type.

Wood shrinks less in the direction which runs from the pith of the tree to the bark, or radially, but it usually shrinks about twice as much tangentially. Lengthwise shrinkage is relatively very small in all woods, running from 1/10 to ⅓ of 1%, and is usually disregarded.

When absolutely green lumber of any species is dried in an oven until free of moisture, it, of course, shrinks appreciably in width. Of course the greater part of this shrinkage has already taken place when air dried lumber is shipped to the consumer and most factories, including Maple Flooring factories, kiln-dry their lumber so that the finished article is free from any further variation in size, except that due to the usual changes in atmospheric conditions.

Broadly speaking air-dried lumber of all kinds will have an average shrinkage of about $\frac{3}{16}$ of 1% in the width of a quarter-sawed board, and about $\frac{5}{16}$ of 1% in the width of a flat-sawed board for 1% change in moisture content. Shrinkage is a very important factor to be considered in any type of construction where tight joining must remain permanent, as in flooring, interior trim and fixtures.

HARD MAPLE ranks very high among the industrial

"Harder to get HARD MAPLE logs in than to sell their product."

woods in its ability to hold its shape under sharp variations of humidity or in other trying conditions where moisture is present. An examination of a HARD MAPLE Floor in service will illustrate this point well. Its tight, close grain makes it almost impervious to moisture.

Strength

The wood of the HARD MAPLE tree is dense, hard and strong. Maple, Beech and Birch have many strength qualities in common, as you will note by examination of the tables. There are many elements which must be considered under the general term "strength"—such as hardness, bending strength, resistance to impact and compression, shearing and tension forces. These different factors of strength will be discussed in a comparative way in the following pages.

Maple is very fine-grained and of uniform cellular structure. Some hardwoods show great variation in cellular

structure with bands of narrow cells and bands of large weak cells with considerable variation as to the combination of these cells in pieces of wood from different trees. That is, some woods are so lacking in uniformity that they may vary from their given strength-averages by considerable percentages. The growth and grain of Maple are such that there is a minimum of difference between one piece and another, from different trees, and the strength values have a strong tendency toward uniformity.

HARD MAPLE IN COMPARISON

The commercial hardwoods of the United States listed in the order of the amount of lumber produced in 1920 are Oak, Maple, Gum, Chestnut, Birch, Yellow Poplar, Beech, Elm, Basswood, Tupelo, Ash and Cottonwood, followed by miscellaneous species of relatively small production. Broadly speaking it is from this list that the large consumer of hardwoods makes his choice. Some of these woods are very strong, others do not rate high in strength but have some special qualities which make them in demand for certain uses. This may be their extreme lightness or ease of working or simply their characteristic attractive appearance when finished in the natural grain. The relative cost of wood is always a large factor in its selection and not infrequently results in the use of a wood not as well suited to a specific purpose as another wood which may cost somewhat more laid down at a given point.

HARD MAPLE ranks high both in finished appearance and in strength qualities. Further, it is not a costly wood and so in one way or another it enters into competition with nearly all of the woods listed above.

The supreme characteristic of HARD MAPLE is its unusual combination of strength qualities and in order to show clearly just how it rates in comparison with other strong woods we shall discuss the weight, strength, shrinkage, hardness, durability and service of the strongest of the American hardwoods—these comprising HARD MAPLE and Rock Elm, Birch, Beech, Oak and White Ash.

Comparative Weights

Weight and strength are very closely associated qualities in wood. HARD MAPLE compares favorably in weight with other woods which approach it in strength qualities. Woods which are lighter lack qualities important in certain forms of service. HARD MAPLE, Oak, Beech, Birch and Rock Elm have nearly the same dry weight per cubic foot. White Ash is somewhat lighter than HARD MAPLE, while White Oak is heavier. Nevertheless HARD MAPLE heads this list under important kinds of strength tests. Other hardwoods and most of the softwoods, of course, are somewhat lighter than HARD MAPLE but they lack the complete combination of strength factors and hardness possessed by HARD MAPLE.

Where lightness is a factor in determining the choice of a wood it is well to consider carefully the other qualities which may be lost. The less weight, the less strength. There is less screw and nail holding power, less resistance to indentation and abrasion and shock and less rigidity in structure, especially where there are joints and fastenings, when a lighter wood is chosen in place of HARD MAPLE.

The interest of the manufacturer in searching for the lightest possible wood in order to reduce transportation charges is often opposed to the interest of the consumer who seeks strength and long service. Consumers are beginning to understand this. For instance, furniture showing a good weight is usually preferred by the consumer as it is indicative of quality. It has strength, rigidity and resistance to marring and will give long service. This is equally true of other articles.

In certain implements and in certain parts of machinery some momentum or balance, which can be given only by a fair normal weight, is very desirable. This is often true also in the choice of woods for mechanical toys and for athletic goods, for example, in such articles as bowling pins, Indian clubs and the well-balanced billiard cue.

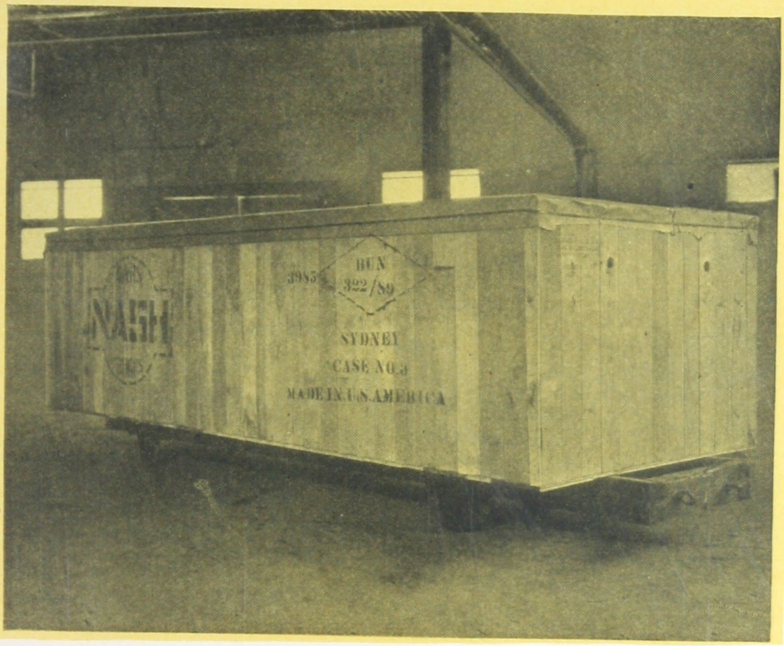
The manufacturer who is anxious to use as light a wood as possible, to save transportation charges, should balance his saving in freights against the strength and service which his product is required to give. On account of the greater strength of HARD MAPLE there are many products in which the parts may be designed smaller and yet retain the same or better strength than would be shown by a lighter wood. This often permits the designer who is familiar with the qualities of HARD MAPLE to bring the weight of the product to the same figure, while retaining equivalent or better mechanical strength factors and frequently improving the appearance of his product. Box and crating material in softwoods must always be of greater dimensions than would be necessary with HARD MAPLE in order to secure the same strength in the shipping container.

COMPARATIVE WEIGHTS

(Results of tests by United States Forest Products Laboratory)

COMMON NAME	Weight Per Cubic Ft. Green	Weight Per Cubic Ft. Air Dry 12% Moisture
Hardwoods:		
Ash, White	46	40
Beech	55	44
Birch, Yellow	58	44
Elm, Rock	54	44
Gum, Red	50	34
MAPLE, HARD	56	43
Oak, Red	64	44
Oak, White	62	48
Softwoods:		
Douglas Fir	38	34
Pine, Loblolly	54	38
Pine, Longleaf	50	42
Pine, Shortleaf	50	38
Pine, West. Yellow	46	28

"NO GUESSWORK IN WOOD-WORKING—WITH HARD MAPLE"



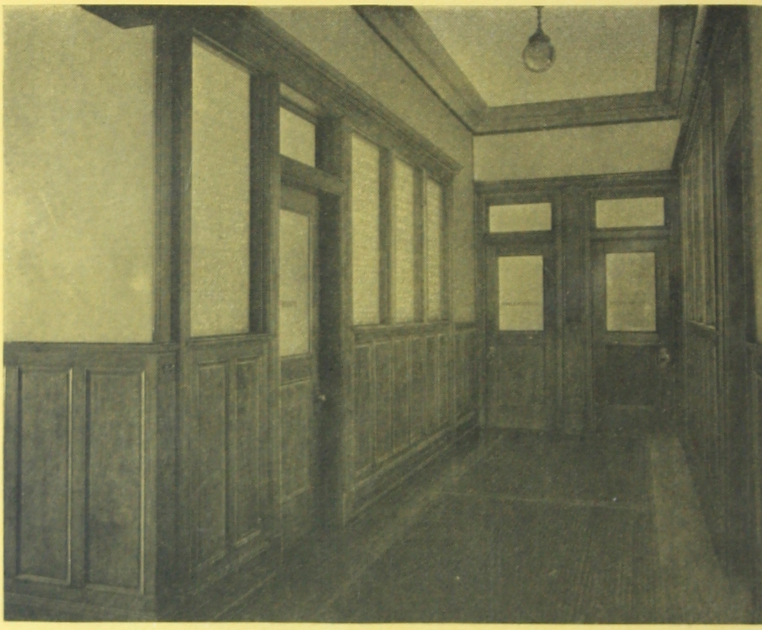
Trimmer, neater, smaller are boxing and crating of HARD MAPLE —with equal or greater sturdiness and no greater weight.

Relative Hardness

Resistance to indentation, abrasion and wear is a very important quality to be considered in selecting a wood for nearly any form of service. HARD MAPLE has this quality in greater degree than any other hardwood available in quantity in the American market. This quality of hardness means not only that the appearance of the wood will be preserved after long service, but that its strength qualities also are protected. When a wood may be easily indented or worn away, its strength qualities are steadily lessened, sometimes even to the point of failure.

This is important in wood parts of automobiles and trucks, in crating material, especially for foreign shipments, and for any other uses of wood where it is subjected to constant wear or the possibility of receiving indenting blows.

In those cases where a fine finish is desirable and the wood either has a polished surface or is under paint or enamel,



Fine HARD MAPLE trim, with artistic gray finish, also HARD MAPLE floors,
Cobbs & Mitchell [redacted] Bldg., Cadillac, Mich.

the hard even surface of Maple guarantees permanence of fine appearance. HARD MAPLE Flooring for this reason is recognized as the most durable wooden floor. It is specified in homes because of its appearance and long service and always in factories where the wear on the floors will be unusually heavy on account of trucking and rolling of heavy factory products.

The following tabulation gives the hardness of Maple as compared with other woods. The figures for hardness, showing the tests when the wood is air dried and the tests made on the side of the piece, are probably of most importance because the forces of wear and indentation ordinarily come against the side grain of air dried wood. HARD MAPLE and Rock Elm lead under these tests, excelling Oak, Black Walnut and even the other northern hardwoods such as Beech and Birch. HARD MAPLE, Birch and Rock Elm are about twice as hard as Red Gum and much

harder than the hardest conifers. When the tests made on the end of the piece are also considered, HARD MAPLE shows as the leader in this list of woods. End hardness should be considered where one piece of wood is joined end-on to another and is subject to a bending strain. The hardness of the outer edges guarantees firmness instead of that looseness which would result if the ends and edges could be easily indented.

Hardness is often of even more importance than appearance in the choice of a wood for interior fixtures, inside trim and furniture. Certainly only the very hardest woods should be used in public buildings where wear and tear is unusually heavy. The hardest of hardwood is most economical in the long run, both in public buildings and private homes, because the fine finished appearance of the surface can be retained only by this quality of extreme hardness.

HARDNESS OF AMERICAN WOODS

(Results of tests by United States Forest Products Laboratory)

COMMON NAME	Percent† Moisture Content Dry Tests	Hardness* Air Dry End Pounds	Hardness* Air Dry Side Pounds	Percent† Moisture Content Green Tests	Hardness* Green End Pounds	Hardness* Green Side Pounds
Hardwoods:						
Ash, White	8.7	1,950	1,320	43	1,000	900
Beech	11.2	1,400	1,190	62	950	820
Birch, Yellow	9.6	1,590	1,320	68	820	740
Gum, Red	11.3	1,010	720	81	630	520
MAPLE, HARD	10.5	2,000	1,430	60	1,000	910
Oak, Red	10.9	1,500	1,310	84	1,020	950
Oak, White	11.5	1,540	1,370	68	1,120	1,060
Rock Elm	8.5	1,730	1,470	50	980	990
Softwoods:						
Douglas Fir	9.4	750	660	36	510	470
Pine, Loblolly	6.5	1,030	840	70	400	450
Pine, Longleaf	9.2	1,140	1,020	47	550	590
Pine, Shortleaf	11.0	940	880	64	490	560
Pine, West. Yellow	10.8	570	460	95	310	320

† The percentage of moisture content is shown because under the tests dry wood shows a change in strength as the moisture content varies.

*Load required to imbed a 0.444 inch ball to one-half its diameter.

RELATIVE SHRINKAGE OF AMERICAN WOODS

GREEN TO OVEN DRY

(Results of tests by United States Forest Products Laboratory)

COMMON NAME	Percent Moisture Content Green	Shrinkage from green to oven dry: In volume percent of dimen. when green	Radial percent of dimen. when green	Tangential percent of dimen. when green
Ash, White	43	12.6	4.2	6.5
Beech	62	16.2	4.8	10.6
Birch, Yellow	68	16.8	7.4	9.0
Elm, Rock	50	14.1	4.8	8.1
Gum, Red	81	15.0	5.2	9.9
MAPLE, HARD	60	14.5	4.8	9.2
Oak, Red	84	14.2	3.9	8.3
Oak, White	68	15.8	5.3	9.0

Irregularities in grain tend to cause wood to warp in drying. There is a minimum tendency to distortion in wood that has a uniform grain and a straight grain.

Beam Strength

If a piece of seasoned wood in the form of a beam is supported only at its two ends and a weight applied in the center of the beam, the load it will carry measures certain strength qualities.

In the next table there are shown the results of such tests made by the Forest Products Laboratory on small, dry, clear specimens of the several woods. The figures given indicate the relative strength of these woods when tested under this kind of loading. The figures should not be used in designing, except by a competent engineer who is familiar with the application of factors of safety to cover both variations in wood structure and variations which take place in wood due to checking.

It is also sometimes necessary to take into account the influence of defects, such as knots, that may be in the piece which is to be used. These tests are for small, clear specimens, free from defects, tested in an air dry condition. Dry wood is stronger than green wood, and strength varies in accordance with the amount of moisture in the wood at

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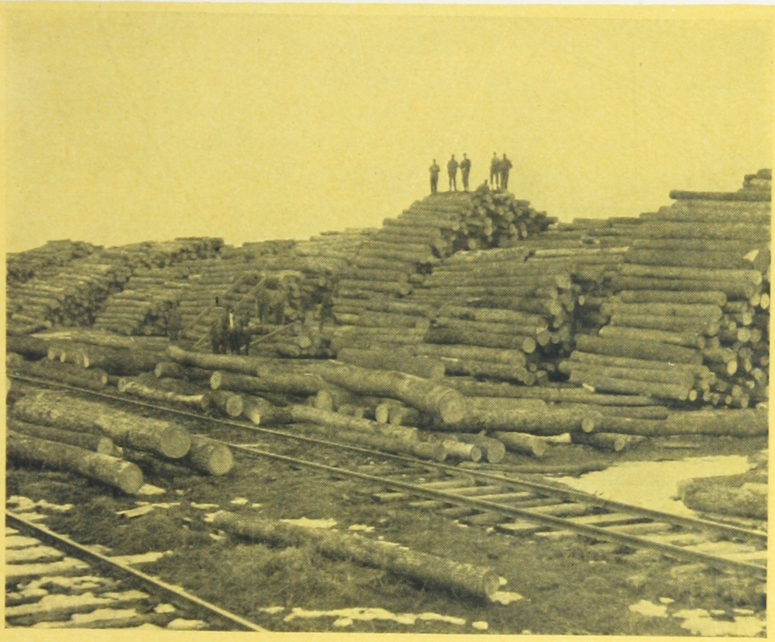

A few minutes' supply of HARD MAPLE for the industrial U. S.

the time of the test. The figures given under Modulus of Rupture may be used in getting a comparative idea of the relative strength of these woods when the load will be applied as indicated above.

It should be kept in mind also, in connection with all of the figures given in this report (particularly those referring to strength properties), that wood is a variable substance and that two trees are seldom alike in strength properties, and two pieces of wood, even of the same species, are not usually likely to have exactly the same strength.

While an effort has been made to secure tests upon average specimens cut from average trees and to average the results of a number of tests, it should be borne in mind that there is a possible leeway of 8% or 10% either way from the figures as given. Sometimes a piece will be found which will show even greater variations. While this is true of all woods, the variation is less in those species which have a uniform even growth and an even grain, such as HARD MAPLE.

Taking the figures for Modulus of Rupture, as given in the table, it appears that under this kind of strain Maple is stronger than White Oak, Beech, Red Oak or Red Gum. Birch also stands out strongly under this test, the figures for Modulus of Rupture being 24% higher than White Oak and 53% higher than those shown for Red Gum.

Safety in design generally causes engineers to use strength test figures from tests made on green timber, which is not as strong as dry timber. That is useful (in order to have a wide factor of safety) especially where the wood is to be used under conditions where it may become moist or where it will be used in the form of very large pieces which may become checked or split by seasoning. The figures showing the tests made upon green wood are given in the latter part of the booklet. (See pages 58 and 59).

When tests are made on green wood the figures for Modulus of Rupture as published by the Laboratory are HARD MAPLE—9,100; White Oak—8,300; Red Oak—7,700; Red Gum—6,800; Birch—8,600; Rock Elm—9,500.

It is worth noting that comparative tests on green wood give figures which are even more favorable to HARD MAPLE than the tabulated comparative results on air dry wood.

The figures showing Fiber Stress at Elastic Limit are very important in determining the proper working stresses for a beam. A beam loaded to its elastic limit in static bending for a short time will recover its form immediately upon removal of the load. If the same load is allowed to remain, complete failure will ultimately result. Consequently, the necessity is apparent for keeping working stresses below the elastic limit. It is usually recommended that working stresses be calculated not from the elastic limit, but from the Modulus of Rupture, because under conditions of testing, there is a personal element in determining the figures for elastic limit. Modulus of Rupture is the computed fiber stress in the outermost fiber of a beam at the maximum load and is a measure of the ability of a beam to support a slowly applied load for a very short time. Modulus of Rupture is always carefully considered in calculating the strength of beams to be used as stringers, floor-joists, etc.

"WHERE JUDGMENT IS BEST, HARD MAPLE IS SUREST"

HARD MAPLE, perfectly piled, in a typical Northern Hardwood Mill Yard.

In some woods, the Modulus of Rupture of small, clear individual pieces will occasionally vary more than 40% above or below the *average* Modulus of Rupture. Pieces showing very low values are almost invariably unusually light, while very strong pieces are exceptionally dense and heavy.

Woods which, within the species, do not vary greatly in their weight have a more uniform strength as between different pieces of the same wood, while those species which are sometimes found light and sometimes heavy, will show great variations in strength within the species. HARD MAPLE is a wood of unusually uniform structure and weight. The Southern Pines are examples of woods which may vary greatly in weight and in strength, in accordance with the density of the particular specie or particular piece. And this is true also of their other strength properties. Douglas Fir shows similar variations. Such woods should be graded or selected on a density basis where their best strength values are to be utilized.

The column of figures under the heading Modulus of Elasticity do not measure the *relative* elasticity of the different kinds of woods. Modulus of Elasticity is, on the other hand, a measure of the stiffness or rigidity.

In the case of a beam, it measures its resistance to deflection. That is, the higher the figure given under Modulus of Elasticity the less will a beam show deflection or bending under a given load. It often is important to determine the probable deflection under loading, or to provide sufficient thickness of material to prevent too great a deflection.

Where wood is used in construction where it must support loads or resist forces applied between points of support or fastenings, the results of the tests given in the table show HARD MAPLE as an exceptionally strong and stiff wood.

STRENGTH—BEAM TESTS

(Results of tests by United States Forest Products Laboratory on air-dried wood in form of small, clear pieces)

		STATIC BENDING		
COMMON NAME	Percent Moisture Content	Fiber stress at elastic limit, lbs. per sq. in.	Modulus of rupture lbs. per sq. in.	Modulus of elasticity, 1000 lbs. per sq. in.
Ash, White	8.7	10,200	16,800	1,810
Beech	11.2	9,000	15,000	1,680
Birch, Yellow	9.6	12,300	18,900	2,200
Elm, Rock	8.5	9,400	16,500	1,610
Gum, Red	11.3	8,400	12,300	1,500
MAPLE, HARD	10.5	10,400	15,800	1,820
Oak, Red	10.9	8,600	14,200	1,870
Oak, White	11.5	8,300	15,200	1,780

The impact-bending tests were made upon small beams 2x2 inches square and 30 inches long supported at the ends so that there was a 28-inch span. A 50-pound hammer was dropped upon the stick to hit the center of the span, first from a height of one inch, next two inches, etc., up to ten inches, then increasing two inches at a time until complete failure occurred. The deflections of the specimen of wood were recorded on a revolving drum by a pointer attached to the hammer. This pointer also recorded the position which the specimen assumed after the shock. In that way data was obtained for determining the various properties of the wood when subjected to shocks.

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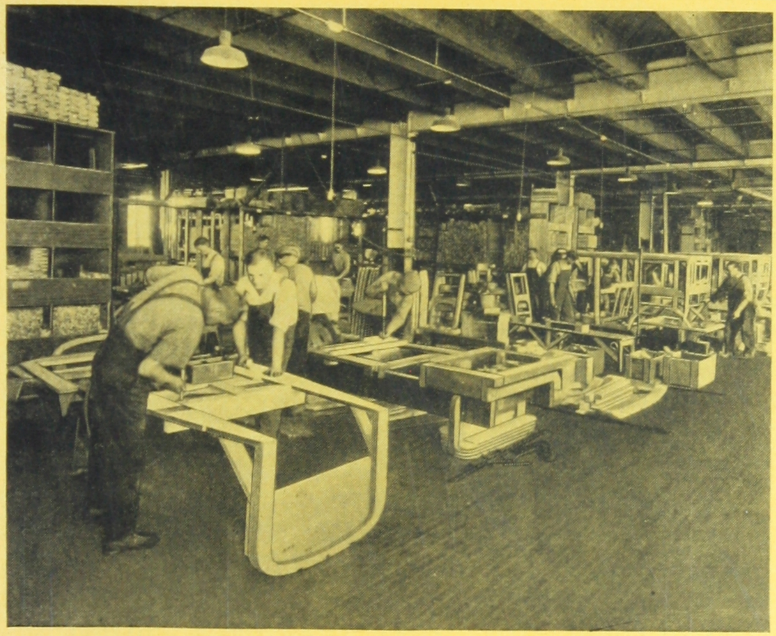


HARD MAPLE is "the rattle-proof hardwood" among Auto-makers.

STRENGTH—IMPACT BENDING

(Results of tests by United States Forest Products Laboratory on air-dried wood)

COMMON NAME	Percent Moisture Content	IMPACT BENDING Fiber stress at elastic limit Lbs. per sq. in.
Ash, White	8.7	17,000
Beech	11.2	19,700
Birch, Yellow	9.6	21,200
Elm, Rock	8.5	18,500
Gum, Red	11.3	19,300
MAPLE, HARD	10.5	19,100
Oak, Red	10.9	18,500
Oak, White	11.5	17,200

Fiber-stress at elastic limit is the greatest stress to which a timber may be subjected under impact loading and recover immediately. Fiber-stress at Elastic Limit in Impact is approximately double the Fiber-stress at Elastic Limit in Static Bending. That is, HARD MAPLE will momentarily stand nearly twice the strain which would ordinarily break it. The hardwoods usually stand high in these tests, while some softwoods will not support a sudden and momentary doubling of the load. The accompanying table shows the relative beam strengths of these species when tests were made on air-dried wood. When the tests were made on green wood the figures for fiber-stress at Elastic Limit under impact bending are as follows:

HARD MAPLE	12,100
Birch	11,700
Rock Elm	11,000
White Oak	10,700
Red Oak	10,400
Red Gum	10,000

Strength—Compression—Shearing and Tension

The next table gives the results of tests of compression parallel to grain, compression perpendicular to grain, shearing strength parallel to the grain and tension perpendicular to the grain on air-dried wood.

In compression parallel to grain, a 2x2x8-inch block was compressed in the direction of its length. The deformation was measured between two points six inches apart on the specimen tested.

Fiber-stress at Elastic Limit in compression parallel to the grain is not much used, because in most cases it is more convenient to use maximum crushing strength, which is less variable and easier to obtain. The value, however, is important in the derivation of safe working stresses for structural timbers.

The maximum crushing strength is the maximum ability of a short block to sustain a slowly applied load. It is obtained by dividing the maximum load obtained in the test by the area of cross section of the block.

This property is very important in estimating the strength of columns. If the column is longer than about ten times

HARD MAPLE Standard Railway Ties awaiting shipment.

its least diameter, some formula should be used which will take care of the increased stress which would be caused by eccentric loading or by the bending of the column. Such formulae are discussed in various text books and are familiar to engineers.

It is noted that Maple and Birch exceed the other hardwoods in their ability to support a load when the wood is in the form of a column. That is, these woods support a greater load per square inch of cross section of the top of the column. In the tests on dry wood Birch is shown to support a heavier load than Maple or Oak. When the green wood was tested the hardwoods were led by HARD MAPLE at 3,860; Birch—3,460; White Oak—3,560; Red Oak—3,200, and Red Gum—2,840.

In the test for compression perpendicular to grain, a block 2x2 inches in cross section and 6 inches long is laid upon its side and pressure is applied to it through a cast iron plate two inches wide laid across the center of the piece

HARD MAPLE excels for lock-corner boxes: Shearing practically nil.

and at right angles to its length. Thus but 1/3 of the surface is directly subjected to compression. The strength value obtained by this test is the fiber-stress at elastic limit and it represents the maximum stress that can be applied to the timber without injury.

This test is important in computing the bearing area for metal fixtures attached to the wood which must support a load and for determining bearing area for beams, stringers and joists. It is useful also in comparing species for railroad ties which must bear the rail, in the design of machines having wooden parts and in automobile design. HARD MAPLE ranks high in this quality, but Rock Elm tests even higher than Maple.

The shearing test is made by applying force to a 2x2 inch lip projecting from the side of a block. The shearing stress is the maximum force required to shear off the projection divided by the area of the plane of failure.

"Shearing strength parallel to the grain" is a measure

of the ability of timber to resist breaking resulting from slipping of one part upon another along the grain. Shearing stress is produced to a varying degree in most uses of timber.

It is most important in beams, where it is known as horizontal shearing—the stress tending to cause the upper half of the beam to slide upon the lower. It is also important in the design of various kinds of timber joints, for instance, in lock-corner boxes. HARD MAPLE easily leads in resistance to shearing along the grain.

Figures showing values for tension perpendicular to the grain are of use in estimating the resistance of timber to the splitting action of bolts and other fastenings.

In tension perpendicular to the grain, HARD MAPLE ranks with the Oaks. Birch and Beech lead in this test in dry wood. Under the tests of green wood, no other wood in the table gives better results than HARD MAPLE. This is an important test to consider in the selection of wood for automobile parts, boxes, crating, etc.

STRENGTH—COMPRESSION, SHEARING AND TENSION

(Results of tests by United States Forest Products Laboratory on air-dried wood in form of small, clear pieces)

COMMON NAME	Percent Moisture Content	Compression parallel to grain: Fiber stress at elastic limit lbs. per sq. in.	Compression parallel to grain: Maximum crushing strength lbs. per sq. in.	Compression perpendicular to grain. Fiber stress at elastic limit lbs. per sq. in.	Shearing strength parallel to the grain lbs. per sq. in.	Tension perpendicular to grain lbs. per sq. in.
Ash, White	8.7	5,600	8,190	1,540	2,110	880
Beech	11.2	4,870	7,400	1,340	1,970	890
Birch, Yellow	9.6	7,720	9,760	1,410	1,880	890
Elm, Rock	8.5	5,510	8,420	1,860	2,140	740
Gum, Red	11.3	4,960	6,020	790	1,750	870
MAPLE, HARD	10.5	6,060	8,570	1,620	2,450	770
Oak, Red	10.9	4,610	7,370	1,210	1,760	780
Oak, White	11.5	4,350	7,610	1,340	2,090	800

Hard Maple Qualities Summarized:

Detailed official strength tests on American woods have become available only in recent years and are known to relatively few fabricators of wood products. The completion of such tests on leading commercial woods by the U. S. Forest Products Laboratory at Madison, Wisconsin, has resulted in the correction of many misapprehensions. Woods which had long served on their general reputation for all around strength have been found to be exceeded in strength values by woods whose mechanical properties were not so generally known.

The detailed evidence presented in this booklet is convincing that HARD MAPLE has no superior as an all around wood of service where strength properties must be considered. HARD MAPLE ranks high or excels in all of the tests which have been devised to determine the service which a wood will give where it must resist stress and strain, shock, indentation or abrasion, or support heavy weights.

Accordingly, fabricators of wooden products seeking efficiency, are now investigating the latest information on the mechanical properties of different woods and taking advantage of these mechanical properties in such a way as to improve their product and likewise reduce the cost.

HARD MAPLE welcomes such a comparison. Intrinsically it has in high measure all of the strength elements together with stability of form. Its strength in proportion to its weight ranks so high that design may frequently be adjusted to secure a better combination of strength with relative lightness than is possible with some other high class wood, or with some other weaker wood, either of which may have been chosen primarily from a cost standpoint. The weaker wood must be worked into larger dimensions, giving more bulk and consuming more board feet, or conversely the stronger wood may be cut to smaller dimensions and still carry the same load while a gain is made in surface hardness, resistance to indentation and abrasion and in the neat appearance of the product.

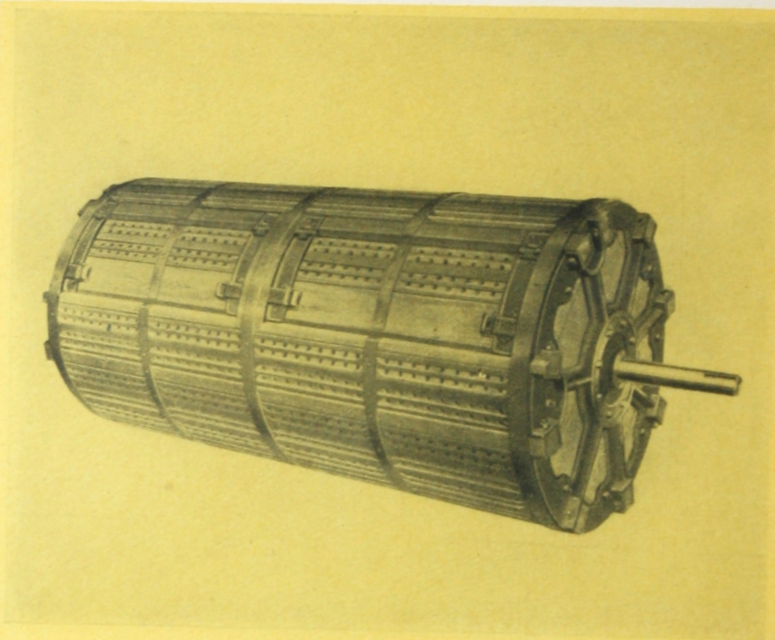
HARD MAPLE ranks high in appearance because its dense, hard surface takes a high polish. The dense, firm character of the wood makes it possible to give it accurate form with clear cut edges which are not easily marred even

"WHERE JUDGMENT IS BEST, HARD MAPLE IS SUREST"

All first-class Bowling Alleys, Pins [redacted] *are always HARD MAPLE.*

though the pattern be intricate. It has an attractive grain in the natural finish or can be stained in that wide range of colors which may be applied to a light colored wood. These qualities have made it a favorite wood for the finished wooden parts of professional and scientific instruments, and in furniture and fine cabinet work.

Its remarkable combination of stability, strength and hardness is shown by its practically exclusive use in the manufacture of shoe-lasts. It is the only wood used in the manufacture of ten-pins because it is the only wood known which will faithfully withstand that exceedingly hard and rough service. High-class bowling alleys are always made of HARD MAPLE. Its preferred use in the manufacture of mallets and mangle-rollers is testimony to its remarkable properties. HARD MAPLE flooring is conceded to be the flooring of longest service. Its use in the manufacture of wash-boards, washing machines and laundry equipment parts testify to its stability and service under particularly

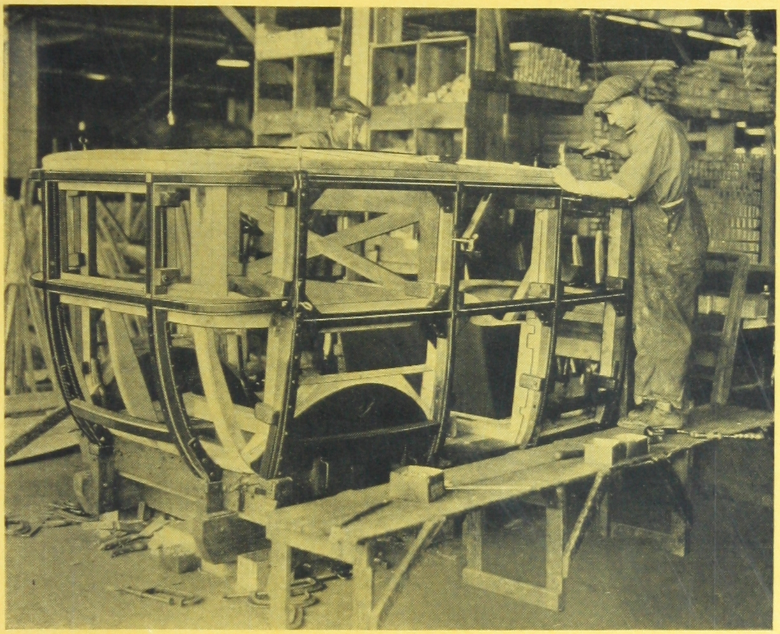


For laundry appliances HARD MAPLE is a preponderant choice.

trying conditions. Manufacturers of folding cots, folding camp-chairs, ladder-rungs, clothes-pins and caster-rollers have long recognized its great strength in those uses where the mechanical properties of the wood must be especially well chosen. Consider those properties of strength, stability and appearance which make HARD MAPLE the choice for such special uses. It is the chosen wood for billiard cues because it does not warp, finishes smooth, and gives balance. That it is used for butter ladles, butter molds, ice cream freezer dashers, wooden spoons and other kitchen woodenware, testifies to its properties as a wood which must come in contact with foods either solid or liquid. It does not impart unpleasant tastes or odors, in fact none at all.

Large quantities of HARD MAPLE are used by the automobile industry. The combination of high strength properties which HARD MAPLE possesses make it the logical wood for body-framework and other wooden parts in pleasure cars and trucks.

"NO GUESSWORK IN WOOD-WORKING—WITH HARD MAPLE"



The better manufacturers demand HARD MAPLE for coach-work.

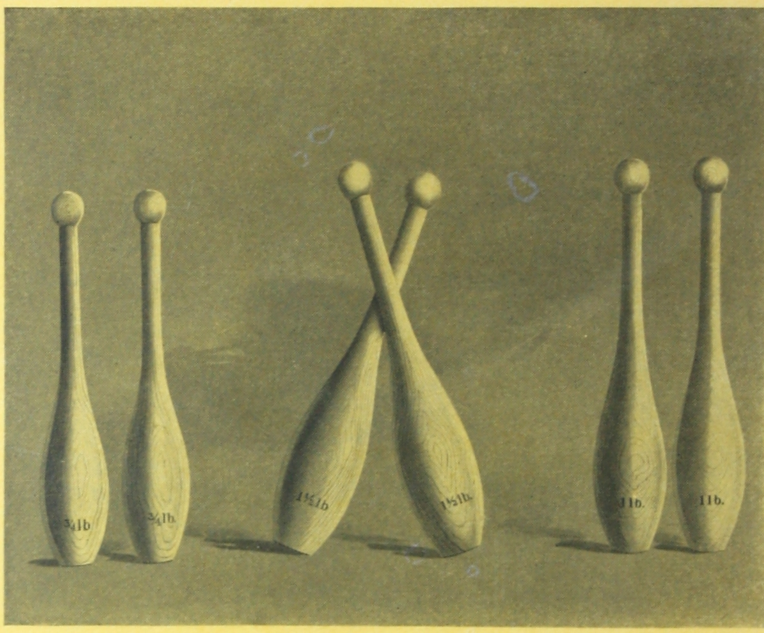
In the industries, HARD MAPLE is indeed the Hardwood Supreme.

SOURCES OF HARD MAPLE LUMBER

Various species of Maple are found in different parts of the United States, but the best HARD MAPLE lumber is produced in the great Northern hardwood forests of Michigan and Wisconsin. Here climatic and soil conditions combine to produce that slow, dense, even growth in hardwoods which is reflected in high and uniform strength values.

It is in Michigan and Wisconsin that the hardwood industry has reached its highest development and here we find the finest hardwood sawmills in the world. These splendid mills in the heart of the Northern hardwood forests, not only have large supplies of standing timber to draw upon, but are equipped with the most modern manufacturing machinery and other facilities which guarantee economies in manufacture, accurate workmanship and uniformity in product. These manufacturing companies are usually large institu-

"WHERE HARD MAPLE IS BEST THERE'S NO SUBSTITUTE"



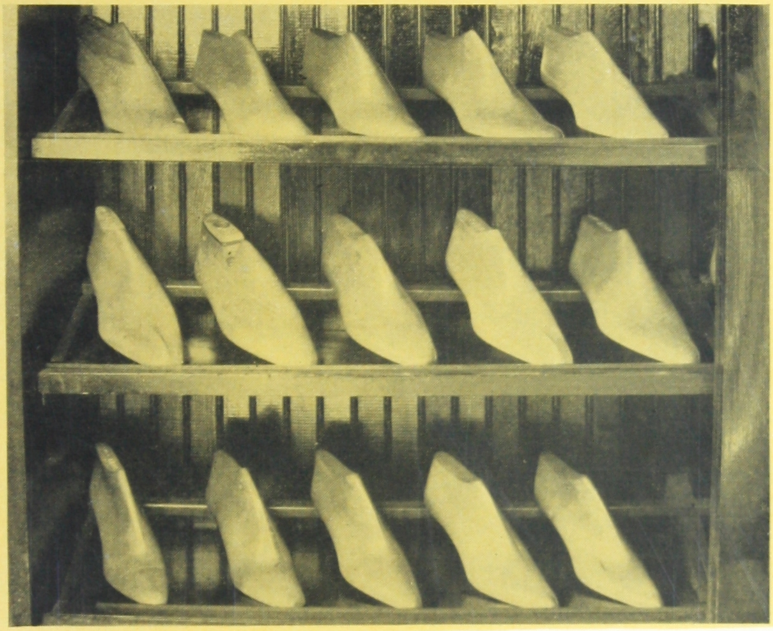
Billiard Cues, Indian Clubs, Bowling Pins, etc.? HARD MAPLE, of course!

tions, many owning their own railroads into the timber, usually having complete planing-mill facilities and often fully equipped with elaborate dry-kilns.

Some of these firms specialize on HARD MAPLE flooring, turning out very large quantities with the most accurate machines known to the industry.

The modern, progressive and well equipped firms are members of the lumber associations, the principal object of which is to establish uniform grades, to see that these grades are understood by the inspectors at the mills of the members, to conduct researches to the end that the product may be improved and to transmit such information to all of the HARD MAPLE lumber manufacturers. These associations maintain a corps of lumber inspectors to visit the different mills to instruct in proper grading and to check up on the work of the local lumber inspectors. The Association inspection service is also available in case of

"WHERE JUDGMENT IS BEST, HARD MAPLE IS SUREST"



80% of all wood used in the shoe industry is HARD MAPLE.

complaints or misunderstandings. It is therefore advantageous to confine your purchases to lumber manufactured at Association mills.

HARD MAPLE is, indeed, a superior wood. A wood whose cleanliness, sturdiness and (so to speak) inborn "self-respectfulness" give it instinctive favor in the esteem and confidence of men and women of like qualities, who discriminate in their selection of those people and things whose service they need and whose faithful performance under every test is the key to their high repute.

The HARD MAPLE lumber and HARD MAPLE flooring that go from Michigan and Wisconsin to serve the critical world, may be said to well deserve the class of manufacturing that is bestowed on them by a class of experienced saw-mill men, of every station, who have spent their lives in this Industry. Some of the operating firms date back to Civil War days and by this time know their Northern hardwoods pretty well.

The great Northern hardwood forests embrace not only HARD MAPLE and the other "quality" hardwoods, but interspersed are also found considerable numbers of excellent softwood trees. Thus a saw-mill operating in HARD MAPLE often manufactures various other lumbers.

It is easily possible, therefore, to obtain mixed shipments when desired, a single car perhaps containing not alone your HARD MAPLE but also one or more of the others—Birch, Rock Elm and Soft Elm, Ash, Beech, Basswood, Soft Maple, Hemlock and Tamarack. Many mills also have White Pine, Norway Pine, Balsam and Oak. Many likewise cut White Cedar for poles, posts and shingles.

The estimated shipping weights of these woods are as follows:

ESTIMATED AVERAGE WEIGHTS OF LUMBER PER 1,000 FEET

	Dry	Green
Black Ash	3,200	4,600
Basswood	2,500	4,200
Beech	4,000	5,750
Birch	4,000	5,500
Elm, Rock	4,000	5,400
Elm, Soft	3,100	4,750
MAPLE, HARD	4,000	5,400
Maple, Soft	3,300	5,000
Oak	4,000	5,500
Hemlock	2,500	.....
Norway Pine	2,700	.....
White Pine	2,500	.....

If the lumber is dressed or otherwise worked through the planing mill, it will weigh much less per 1,000 feet than in the rough.

Descriptive lists showing names and addresses, shipping service, kinds of lumber manufactured, special products made and facilities of each mill may be obtained upon application.

"NO GUESSWORK IN WOOD-WORKING—WITH HARD MAPLE"

HARD MAPLE deserves, and gets, respectful treatment in storage.

GRADES AND INSPECTION

The manufacturers of HARD MAPLE lumber of Michigan and Wisconsin sell their product under the grading rules of the National Hardwood Lumber Association. These grading rules are the development of many years of thorough consultation among manufacturers, distributors and consumers of hardwood products. They are recognized as standard throughout the United States and abroad. HARD MAPLE Flooring is manufactured under the rules of the Maple Flooring Manufacturers' Association, which rules have been adopted by the National Hardwood Lumber Association as standard for flooring.

The standard thickness of Maple Flooring is $\frac{13}{16}$ inch, produced in $1\frac{1}{2}$, 2, $2\frac{1}{4}$ and $3\frac{1}{4}$ inch faces. The Special thicknesses are $1\frac{1}{16}$, $1\frac{5}{16}$ and $1\frac{11}{16}$ inch, produced in 2, $2\frac{1}{4}$ and $3\frac{1}{4}$ inch faces. Thin flooring $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{5}{8}$ inches thick is made in $1\frac{1}{2}$, 2 and $2\frac{1}{4}$ inch faces.

The $\frac{13}{16}$ inch thickness is most commonly used for nearly all new work and for replacing old floors. The $\frac{3}{8}$ inch thickness is in great demand for re-surfacing old floors and can be used in new construction over good sub-floors.

The standard grades of Maple Flooring are Clear, No. 1 and Factory. Some manufacturers also offer the special grade of White Clear Maple in $\frac{13}{16}$ inch and $\frac{3}{8}$ inch thicknesses. This grade is "Clear" Maple carefully selected for color and makes an exceptionally attractive floor for rooms where dainty effects are desired. Maple can also be stained to harmonize with color schemes.

The "Clear" grade shows some variation in color and makes the most durable and finest appearing flooring available for any building.

The No. 1 grade is the second quality—just as serviceable as Clear, and can be used in the same type of buildings as Clear, when slight imperfections in appearance are admissible. The No. 1 grade is also used for the finer industrial floors.

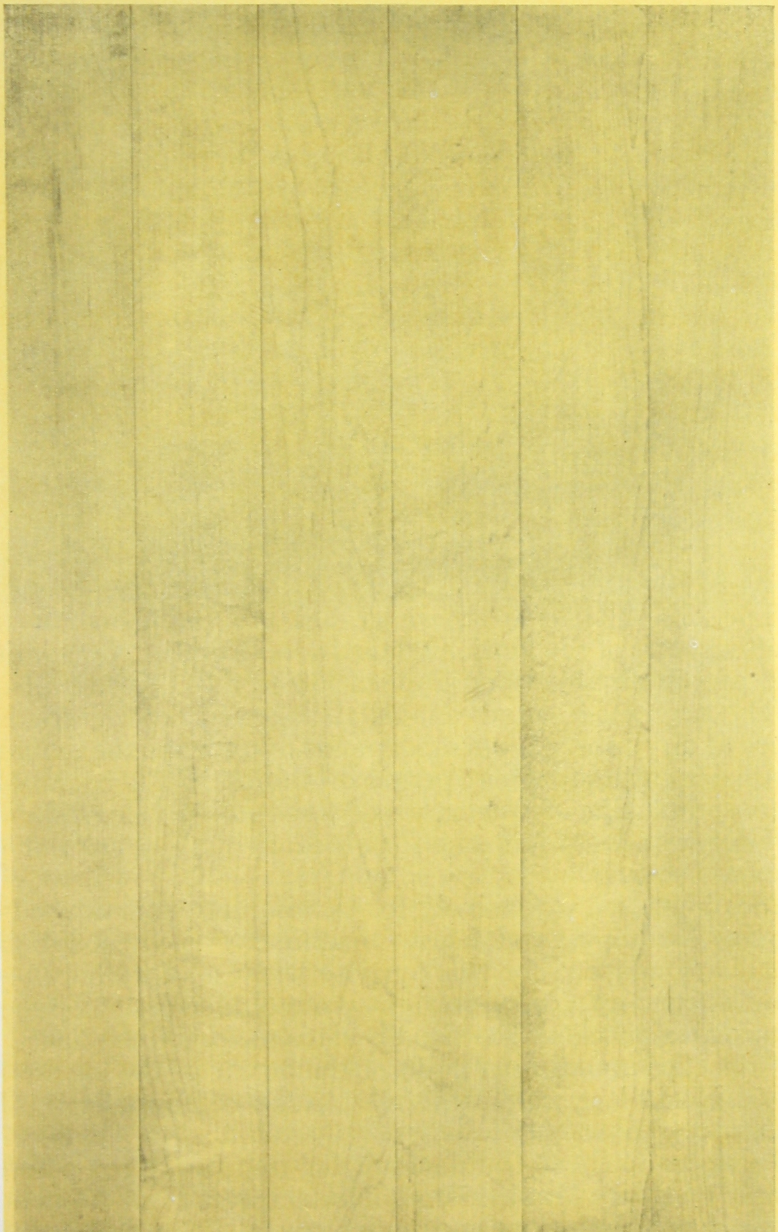
The "Factory" or third grade is generally employed for storerooms, warehouses, factories, granaries, subfloors, and similar work. Nothing of equal value can be obtained at similar cost.

Remember that HARD MAPLE makes the hardest floor that can be obtained and costs but little more than the best grades of softwood flooring. It holds its smooth surface and finished appearance longest because Maple polishes under friction and builds up its own resistance to wear.

Some manufacturers of Maple Flooring also make Beech and Birch Flooring. These woods are also very hard and possess distinctive, warm and pleasing color tones. They readily take on any color stain. Beech and Birch are available in the same sizes and grades as Maple Flooring.

The Grading and Inspection Rules of the National Hardwood Lumber Association classify HARD MAPLE boards by a system which divides the product into a number of classifications that are so arranged as to meet the usual requirements of the trade. This organization maintains inspectors who are located in many cities throughout the producing and consuming sections so that an official inspection may readily be obtained.

"WHERE JUDGMENT IS BEST, HARD MAPLE IS SUREST"



"HARD MAPLE, the most all-round satisfactory flooring ever laid."

The sawmills cut the logs into boards, planks or timbers in the thicknesses for which there is a common demand by the trade. These thicknesses are usually in gradations of a quarter of an inch, generally running 4/4, 5/4, 6/4, 7/4, 8/4, 9/4, 10/4, 12/4, 14/4 and 16/4. They are also cut into squares running from 4″x4″ to 8″x8″ free of heart. Larger sizes are usually produced by boxing the hearts.

Knots in Maple are usually small, firm, sound and of the color of the wood.

Under the grading rules, the lumber produced from a log is usually classified into six grades. These grades are as follows:

Firsts and Seconds.
Selects.
No. 1 Common.
No. 2 Common.
No. 3 Common A.
No. 3 Common B.

The descriptions of these grades are published in the grading rules of the National Hardwood Lumber Association and are obtainable upon application to any of the mills.

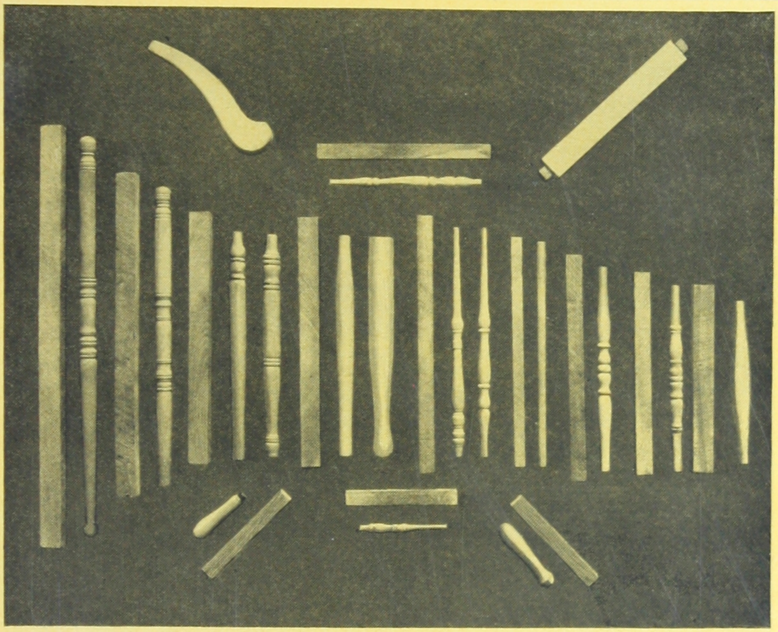
The percentage of any one of the above grades carried in stock at any time, of course, depends upon what the demand has been during a recent period of months. There may be an accumulation or a shortage of stock in a given grade.

Timbers are seldom cut for stock items but are cut on special order.

Maple is used extensively for turning into rollers used in moving buildings and heavy machinery, the wood being peculiarly adapted for this purpose because of its hardness, firm texture and natural straight-grain tendencies. Timbers for turning purposes are usually cut outside of the heart.

Cross ties are also sawn out of the hearts of the log at the saw mill and large quantities are purchased annually by the railroads.

In order to meet the demand for uniform, light colored Maple or White Maple many manufacturers stack a portion of their production on end under cover which permits the drying of lumber under protected conditions and without the use of cross stickers. White Maple is produced from small to medium sized logs and does not as a rule, average



HARD MAPLE the prevailing choice for high-grade small parts.

as wide as ordinary flat-piled stock. The process of curing end-dried White Maple naturally results in quite a little higher production cost than in the case of stock cured under ordinary conditions. The boards must be narrower because they usually must be cut from the outside of the log which does not contain any of the colored heart wood and the outside cuts must be narrower.

Manufacturers of lumber seldom sort out Birdseye Maple or Curly Maple. Some of the veneer manufacturers specialize in Birdseye and Curly Maple and manufacture the veneer direct from HARD MAPLE logs.

Some sawmills manufacture small dimension stock which is usually in the form of squares, 1″x1″ to 3″x3″ running in lengths from 18″ up to 48″. The squares must be clear. They are in demand by the furniture trade, implement manufacturers and other wood consuming industries. This business involves certain complications so that all mills do not have small dimension stock available but most of them

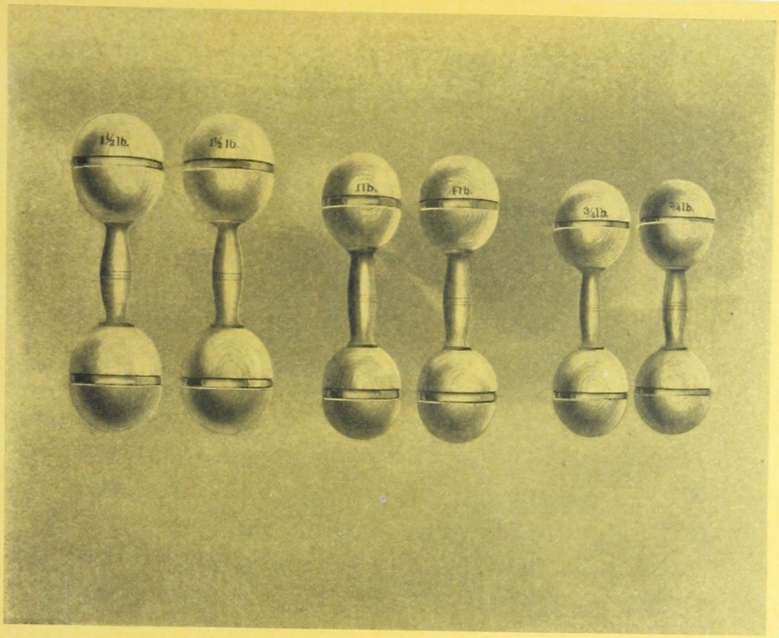
Buyers of wire-reels and spools insist on HARD MAPLE.

will consider contracts for the manufacture of such material if satisfactory prices are offered. The production of these small pieces involves relatively large labor costs on account of handling. Small Dimension stock is not waste material but is really material in finished form, such as is obtainable from the highest grade of lumber, free from all defects and from the best part of the log.

The box manufacturing industry consumes large quantities of the lower grades of Maple, such as the No. 3 Grade. This grade is also in demand by the railroads for the manufacture of grain-door boards for freight cars. It is also in demand for cutting up into small dimension stock for use as crating for heavy materials.

There are a number of HARD MAPLE products which are the products of the log rather than of lumber and which are not ordinarily handled at sawmills. For instance, "last-blocks" for the manufacture of shoe-lasts, and blocks from which bowling pins may be turned, and dimension

"WHERE JUDGMENT IS BEST, HARD MAPLE IS SUREST"



All good dumb-bells are HARD MAPLE. Ask anybody.

stock for cant-hook handles. Items of this class are generally produced in rough form by those who buy the logs and convert them with special machinery or equipment. Inspection rules are available to cover most of these miscellaneous products.

The grading rules for hardwoods, including HARD MAPLE and for any of the other woods mentioned above, can be obtained upon application to any of the mills or to the Association offices.

USES OF HARD MAPLE

HARD MAPLE lumber is an important raw material in fifty-two industries as classified by the U. S. Census Bureau. In these industries Maple has been specified and used because its combination of properties has made it the logical choice for a certain purpose. These industries listed approximately in their order as quantity consumers of HARD MAPLE are as follows:

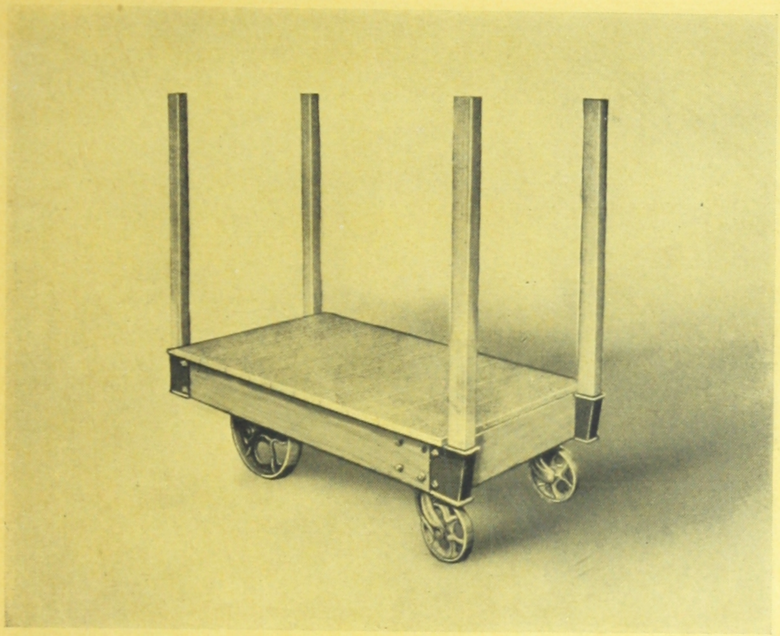
HARD MAPLE IN THE INDUSTRIES

(Classification of the U. S. Bureau of the Census.)

INDUSTRY:

Automobile
General Mill Work—Hard Maple Flooring
Boxes and Crates
Furniture
Boot and Shoe Findings
Agricultural Implements
Chairs and Chair Stock
Instruments, Musical
Handles—Tool, Broom, Peavy, Pail, etc.
Woodenware and Novelties
Dairy, Poultry and Aparian Supplies
Vehicles and Vehicle Parts
Fixtures
Laundry Appliances
Shuttles, Spools and Bobbins
Refrigerators and Kitchen Cabinets
Car Construction
Trunks
Sporting and Athletic Goods—Bowling Equipment
Instruments, Professional and Scientific
Toys
Machine Construction
Pulleys and Conveyors
Butchers' Blocks and Skewers
Brushes—Backs
Pumps and Wood Pipe
Elevators
Saddles
Dowels
Toothpicks and Clothespins
Machinery and Electrical Apparatus
Whips, Canes and Umbrella Sticks
Ship and Boat Building
Mine Equipment—Mine Rollers

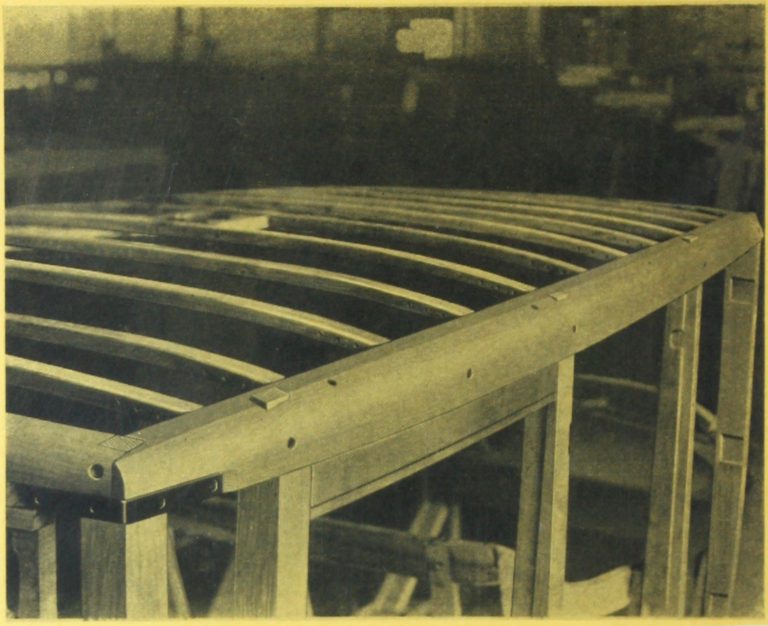
"NO GUESSWORK IN WOOD-WORKING—WITH HARD MAPLE"



Sturdy trucks are sturdiest if made of HARD MAPLE.

HARD MAPLE IN THE INDUSTRIES (Continued)

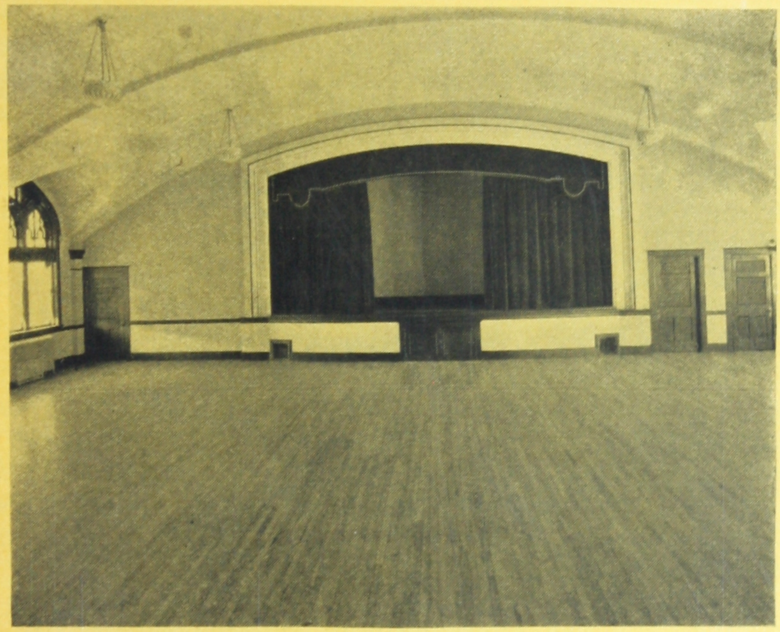
Rollers, Shade and Map
Bungs and Faucets
Equipment, Playground
Printing Material
Brooms and Carpet Sweepers
Weighing Apparatus
Plumbing Woodwork
Sewing Machines
Frames and Moulding, Picture
Tanks and Silos
Artificial Limbs
Gates and Fencing
Patterns and Flasks
Caskets and Coffins
Signs and Supplies
Clocks



Screws stay snug and tight in HARD MAPLE bodies. It pays.

The automobile industry uses large quantities of HARD MAPLE because it is the "rattle-proof hardwood". The wood frame-work in an automobile body is subjected to constant strains which tend to loosen the joints of the frame-work and to loosen fastenings, screws and bolts. It is therefore important that the best possible wood be chosen for this construction. Bolts, fastenings and screws in HARD MAPLE remain tight and firm. These fastenings do not wear or sink into the wood. Wood when firmly fastened to steel deadens metallic vibration. HARD MAPLE combines the factor of great strength with resiliency and power to absorb heavy shocks without failure of the structure. The purchasers of automobiles are paying increasing attention to the kind of wood used in the body frame because they have come to realize that frame-work without these qualities will not give the services they require.

The manufacturers of flooring use enormous quantities



"HARD MAPLE is the true Aristocrat of Ball-room Flooring."

of HARD MAPLE lumber. It makes the hardest and most wear-resistant wooden flooring in commerce. It gives long service under heavy trucking in factories and under covered platforms. Its appearance makes it in demand for public buildings and in homes of the highest class. Certain grades of Maple flooring are particularly adapted to factory use, where service and economy are more desirable than appearance. These grades may include short lengths and no selection is made for color nor for certain other blemishes in appearance. (Also see page 42).

The best HARD MAPLE Floors cost but little more than the better grades of softwood floors but give much greater value in long service and in appearance.

The box industry uses HARD MAPLE for expensive, highly finished boxes to meet the special demand of some industries, and also uses large quantities of the lower grades to make stronger boxes for certain purposes and to strengthen ordinary boxes with HARD MAPLE ends and cleats.

The manufacturers of furniture like the finished appearance of Maple and use this wood including selected Maple veneers in the natural finish or stain. It also is a recognized wood in the industry for those parts of furniture where considerable strength is required even though the wood itself may be concealed, as in upholstered furniture. For sliding parts such as drawer-sides and extension-table slides, HARD MAPLE is the preferred wood because it wears smoothest and lasts longest.

HARD MAPLE plays an important part in the boot and shoe industry where it is considered the only wood suitable for the manufacture of shoe-lasts. This product requires great hardness in the wood and stability of the shape or pattern. This industry also uses considerable HARD MAPLE in the manufacture of heels for ladies' shoes. Eighty per cent. of the wood used in the boot and shoe industry is HARD MAPLE.

The makers of agricultural implements, various kinds of machines and the manufacturers of vehicles and vehicle parts use large quantities of HARD MAPLE for those parts where strength and firmness can best be given by the use of an intelligently selected hardwood.

The makers of high-grade musical instruments use more HARD MAPLE than any other wood because of its well recognized and peculiar character of resonance, a quality possessed by very few woods. Maple is the best hardwood to use where musical tones must be preserved and strengthened. Further, exposed parts will take a very attractive finish.

Manufacturers of woodenware, dairymen's supplies and beekeepers' supplies, also use a great deal of HARD MAPLE because the wood may be accurately machined and does not impart unpleasant tastes to food products.

A very large quantity of HARD MAPLE is used by the manufacturers of interior fixtures. Here the appearance of the finished wood either natural or stained, together with its hardness guaranteeing against dents and abrasion, have dictated the choice.

In the manufacture of laundry appliances, it is apparent that the stability of Maple under trying conditions and the service which it gives under those conditions, has made it a

Hard Maple in its vital service to the subtlest of Arts.

preferred wood. This industry uses more HARD MAPLE than any other hardwood.

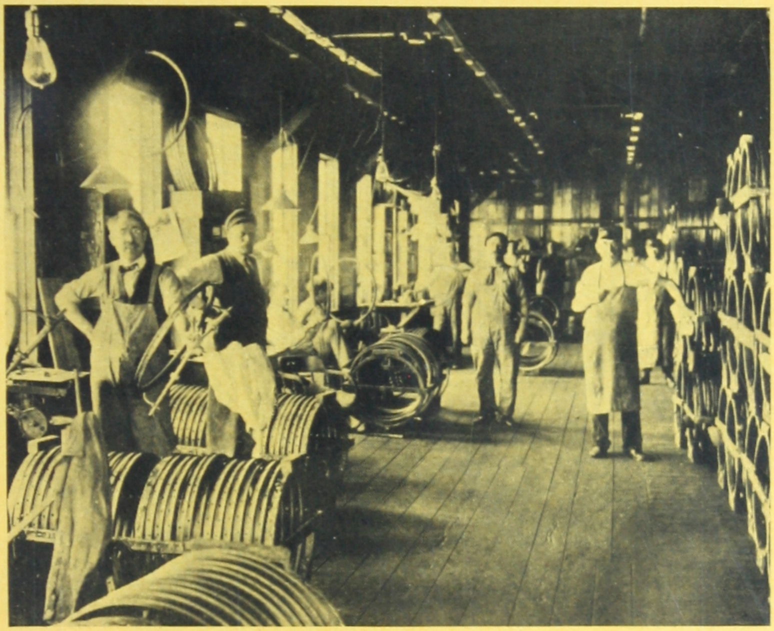
The manufacturers of sporting and athletic goods choose Maple for many of their products where special qualities in the wood are essential. Billiard cues are made of HARD MAPLE because strength and stability of line are essential. High-class bowling alleys are always made of HARD MAPLE because only a hard, smooth floor which remains hard and smooth is considered satisfactory. Although many experiments have been made with bowling pins made from various kinds of wood, HARD MAPLE is the only kind of wood which has stood up and is the only wood used in the manufacture of ten pins. Pins made of other woods tested would crack in two or chip off after a few games. Further, it was found that the setting up of such pins rounded off the base edges rapidly enough so that in a relatively short time, such pins were more easily upset. HARD MAPLE does not chip off, break, nor round off at the edges until after very long service. The physical qualities which have been demonstrated in the strength test tables account for this service.

HARD MAPLE is nearly always the wood specified for rollers for moving very heavy objects.

Wooden pulleys are nearly always made of HARD MAPLE because this wood is strong and will hold an even surface. Wood Pulleys are much lighter in weight than any metallic pulleys, consequently they are installed more easily and quickly, and they impose only a light load upon the shaft; the wood face offers greater traction to the belt than metal, so that more power may be transmitted with the same belt; they will operate safely at higher speeds than ordinary metal pulleys and they cost less. In some service, as in driving stamp mills and crushers, pulleys are subjected to severe, recurrent shocks or vibrations which often cause metal to crystallize and break. HARD MAPLE is the chosen wood for Wood Pulleys.

Wood bicycle rims are always made of HARD MAPLE. It is one of the few woods which will meet the peculiar requirements of this service safely.

Its peculiar qualities may be recognized in the fact that HARD MAPLE is used for the manufacture of wooden type and bevel gears.



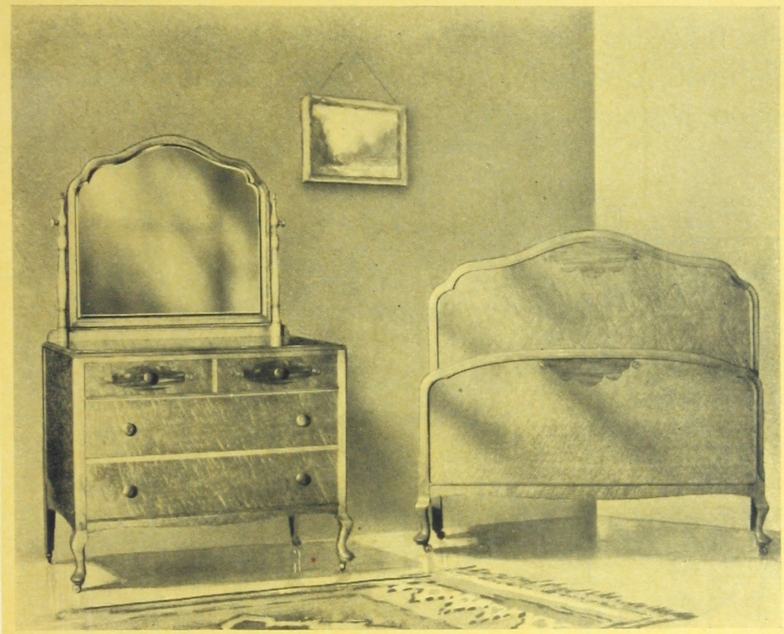
Nothing but HARD MAPLE will do for Bicycle-rims.

Manufacturers of toys want either a very light, easily worked wood or one which is as light as feasible considering the rough service which it must stand. For small articles such as dolls, Basswood often has the best combination of properties. Where strength enters as an important factor HARD MAPLE is usually chosen. Both woods take paints, stains and enamels and HARD MAPLE takes the high natural finish often important in toy production. Basswood, Maple, Beech and Birch are by far the leading woods in the toy industry.

On the following page are listed some of the important uses of HARD MAPLE. In each case HARD MAPLE has been selected for a use having special requirements. Now that you have read of the peculiar qualities of HARD MAPLE you will readily understand why it has been selected for these uses.

Some of the Important Uses of Hard Maple

AUTOMOBILE BODY FRAMES AND WOODEN PARTS
AGRICULTURAL IMPLEMENTS
BASEBALL BATS
BASKETS, VENEER
BEDROOM FURNITURE
BENCH TOPS (working benches)
BILLIARD CUES
BILLIARD TABLES
BLUEPRINT FRAMES
BOAT TRIM
BOBBINS
BOBSLEDS
BOTTOMS (delivery wagon trucks)
BOWLING ALLEYS
BOXES
BREAD BOARDS
BROOM HANDLES
BRUSH BACKS
BRUSH HANDLES
BUTCHER BLOCKS
BUTTER LADLES
BUTTER CHURNS
BUTTER MOULDS
CAMERAS
CANES
CANT HOOK (handles)
CAR FINISH
CAR FLOORING
CARPET SWEEPERS
CASTER ROLLERS
CEILING
CHAIR BOTTOMS
CHAIRS
CHEESE BOXES
CHECKERS
CHILDREN'S WAGONS
CHURCH FURNITURE
CLOTHESPINS
COAT HANGERS
COOPERAGE STOCK
CORN PLANTERS
CORN SHELLERS
COT FRAMES
CROQUET MALLETS
CROQUET BALLS
CULTIVATOR HANDLES
CURTAIN POLES
DESKS
DISHES
DIE BLOCKS
DOORS
DOWELS
DOMINOES
DRILL FRAMES
DUMBWAITERS
DUMB-BELLS
ELECTROTYPE BLOCKS
ELEVATORS
ENSILAGE CUTTER FRAMES
FACTORY TRUCKS
FEEDERS (printing machinery)
FIXTURES
FLASKS (foundry)
FOLDING CAMP CHAIRS
FLOORING
FURNITURE
FREEZER DASHERS
GARMENT HANGERS
GAMES
GEARS, BEVEL (wood)
GO-CARTS
GRAIN DRILLS
GRAIN SEPARATORS
GRASS SEEDER FRAMES
GUITARS (mandolin and harp bodies)
GRAIN DOORS and COAL DOORS (railway freight cars)
HAMES
HANDLES
HOOPS (musical drums)
HAY PRESSES
INDIAN CLUBS
INTERIOR FINISH
KITCHEN CABINETS
LADDER RUNGS
LASTS
LAP BOARDS
LAWN MOWER HANDLES AND ROLLERS
MALLETS (stone cutters)
MANGLE ROLLERS
MAP ROLLERS
MEDICINE CABINETS
MERRY-GO-ROUNDS
MOULDING
MUSICAL INSTRUMENTS
NOVELTIES
OFFICE FIXTURES
ORGANS (pipe and reed)
PADDLES (boat)
PARASOL HANDLES
PARTITIONS
PARQUETRY FLOORING
PIANOS
PIANO BRIDGES (actions and cases)
PIANO PLAYERS
PLOW BEAMS



HARD MAPLE furniture: durable, "mar-proof" and lovely.

Some of the Important Uses of Hard Maple (Continued)

PLUMBING WOODWORK
PORCH SWINGS
POTATO MASHERS
PULLEYS AND PULLEY BLOCKS
PUMPS
RACKS
RAILROAD TIES
REFRIGERATORS
ROAD ROLLERS
RULES (yard sticks and measuring)
INSTRUMENTS
SASH
SCHOOL FURNITURE
SEPARATORS
SHOE FORMS
SHOE HEELS
STAIR HAND RAILS
SHOW CASES
SIGNS
SKIDS
SLIDES (table and drawer)
SLEIGHS AND SLEDS
SPOONS
STEERING WHEELS
STANCHIONS
TANKS
TANNING DRUMS
TALKING MACHINES
TEN PINS
THREADERS
TOOTHPICKS
TOYS
TOWEL RACKS AND ROLLERS
TYPE CABINETS
TUBS
UMBRELLA HANDLES
VEHICLES
WAGONS
WASHBOARDS
WASHING MACHINES
WASH TRAY COVERS
WHEELBARROWS
WOODEN BEARINGS
WOODEN SPIGOTS AND FAUCETS
WOODENWARE
WOOD TYPE
WORK BOARDS (paper hangers)
WRINGER FRAMES

The following tables show the results of the strength tests made upon American hardwoods in the form of small clear pieces in a green condition:

STRENGTH—BEAM TESTS

(Results of tests by United States Forest Products Laboratory on wood in green condition)

COMMON NAME	Percent Moisture Content	STATIC BENDING Fiber stress at elastic limit lbs. per sq. in.	STATIC BENDING Modulus of rupture lbs. per sq. in.	STATIC BENDING Modulus of elasticity, 1000 lbs. per sq. in.
Ash, White	43	4,900	9,100	1,350
Beech	62	4,500	8,200	1,240
Birch, Yellow	68	4,600	8,600	1,540
Elm, Rock	50	4,600	9,500	1,190
Gum, Red	81	3,700	6,800	1,150
MAPLE, HARD	60	5,000	9,100	1,480
Oak, Red	84	3,700	7,700	1,290
Oak, White	68	4,700	8,300	1,250

STRENGTH—IMPACT BENDING

(Results of tests by United States Forest Products Laboratory on wood in green condition)

COMMON NAME	Percent Moisture content	IMPACT BENDING Fiber stress at elastic limit Lbs. per sq. in.
Ash, White	43	11,700
Beech	62	10,400
Birch, Yellow	68	11,700
Elm, Rock	50	11,000
Gum, Red	81	10,000
MAPLE, HARD	60	12,100
Oak, Red	84	10,400
Oak, White	68	10,700

STRENGTH—COMPRESSION, SHEARING AND TENSION

(Results of tests by United States Forest Products Laboratory on wood in green condition)

COMMON NAME	Percent Moisture Content	Compression parallel to grain Fiber stress at elastic limit lbs. per sq. in.	Compression parallel to grain Maximum crushing strength lbs. per sq. in.	Compression perpendicular to grain. Fiber stress at elastic limit lbs. per sq. in.	Shearing strength parallel to the grain lbs. per sq. in.	Tension perpendicular to grain lbs. per sq. in.
Ash, White	43	3,230	3,800	800	1,260	620
Beech	62	2,550	3,280	610	1,210	760
Birch, Yellow	68	2,760	3,460	450	1,110	480
Elm, Rock	50	2,870	3,780	750	1,270	660
Gum, Red	81	2,360	2,840	460	1,070	510
MAPLE, HARD	60	3,120	3,860	750	1,380	770
Oak, Red	84	2,330	3,200	730	1,120	740
Oak, White	68	2,990	3,560	830	1,250	770

SPECIAL SERVICE TO YOU

The leading Northern HARD MAPLE Manufacturers of Michigan and Wisconsin are members of either the Northern Hemlock and Hardwood Manufacturers' Association or the Michigan Hardwood Manufacturers' Association.

Through these Associations the lumber manufacturers desire to be of every possible assistance to all consumers, and they welcome correspondence to that end.

Lumber freight rates will be quoted, grading rules furnished, and information given as to inspection service and methods of obtaining it, on various kinds of wood.

The HARD MAPLE manufacturers employ experts, not to sell lumber but to study wood utilization problems. It is often possible, upon request, to have one of these thoroughly practical specialists visit your premises so that you may discuss the questions involved in the better selection of wood and its more economical application. There is no charge for this service.

These Associations *do not sell lumber*, but they are glad to furnish you with lists giving names, addresses, shipping facilities and principal products of the individual mills.

Hard Maple, Soft Maple, Birch, Beech, Hard and Soft Elm, Basswood, Ash, Cedar, White Pine, Norway Pine, Balsam, Hemlock and Tamarack all grow in Michigan and Wisconsin. As a result the manufacturers of HARD MAPLE also produce many or all of these woods. More detailed information about any of these species is gladly furnished on request.

NORTHERN HEMLOCK & HARDWOOD MFRS'. ASS'N.
Oshkosh, Wisconsin.

MICHIGAN HARDWOOD MANUFACTURERS' ASS'N.
Cadillac, Michigan.

Hard Maple

The Standard

in the

Industries

(Hard Maple)

CROSBY CHICAGO